

IN THE CLAIMS:

Claim 1 (currently amended): An ultrasonic probe comprising a layered ultrasonic transducer having a first part and a second part which are adjacent to each other, wherein

each of the first part and the second part includes:

a piezoelectric section body including a plurality of first horizontal electrode layers and a plurality of second horizontal electrode layers alternately provided in the vertical direction;

a first vertical electrode layer electrically connected with the plurality of first horizontal electrode layers; [[and]]

a second vertical electrode layer electrically connected with the plurality of second horizontal electrode layers,

a first vertical insulating layer extending in a sheet-like manner in the vertical direction between a first side surface of the piezoelectric section body and the first vertical electrode layer, the first vertical insulating layer insulating the first vertical electrode layer from an inner electrode layer within the plurality of second horizontal electrode layers; and

a second vertical insulating layer extending in a sheet-like manner in the vertical direction between a second side surface of the piezoelectric section body and the second vertical electrode layer, the second vertical insulating layer insulating the second vertical electrode layer from an inner electrode layer within the plurality of first horizontal electrode layers;

the first vertical electrode layer included in the first part and the first vertical electrode layer included in the second part being adjacent to each other via a first gap region and having the same polarity, and

the ultrasonic transducer includes a first specified structure formed by the first vertical electrode layer included in the first part, the first vertical electrode layer included in the second part, and the first gap region.

Claim 2 (currently amended): An ultrasonic probe according to claim 1, wherein the ultrasonic transducer further comprises a third part adjacent to the second part, the third part including:

a piezoelectric section body including a plurality of first horizontal electrode layers and a plurality of second horizontal electrode layers alternately provided in the

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vertical direction;

a first vertical electrode layer electrically connected with the plurality of first horizontal electrode layers; and

a second vertical electrode layer electrically connected with the plurality of second horizontal electrode layers,

a first vertical insulating layer extending in a sheet-like manner in the vertical direction between a first side surface of the piezoelectric section body and the first vertical electrode layer, the first vertical insulating layer insulating the first vertical electrode layer from an inner electrode layer within the plurality of second horizontal electrode layers; and

a second vertical insulating layer extending in a sheet-like manner in the vertical direction between a second side surface of the piezoelectric section body and the second vertical electrode layer, the second vertical insulating layer insulating the second vertical electrode layer from an inner electrode layer within the plurality of first horizontal electrode layers;

the second vertical electrode layer included in the second part and the second vertical electrode layer included in the third part being adjacent to each other via a second gap region and having the same polarity, and

the ultrasonic transducer further includes a second specified structure formed by the second vertical electrode layer included in the second part, the second vertical electrode layer included in the third part, and the second gap region.

Claim 3 (original): An ultrasonic probe according to claim 2, wherein each of the first specified structure and the second specified structure is configured symmetrically in the horizontal direction.

Claim 4 (original): An ultrasonic probe according to claim 2, wherein the first specified structure and the second specified structure are mutually inverted in the vertical direction.

Claim 5 (cancelled).

Claim 6 (original): An ultrasonic probe according to claim 2, wherein the first vertical electrode layer included in the first part, the second part, and the third part is one of a ground vertical electrode layer or a signal vertical electrode layer, the second vertical electrode layer included in the first part, the second part, and

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the third part is the other one of a ground vertical electrode layer or a signal vertical electrode layer,

the first specified structure is one of a specified structure for ground or a specified structure for signal, and

the second specified structure is the other one of a specified structure for ground or a specified structure for signal.

Claim 7 (original): An ultrasonic probe according to claim 2, wherein
the ultrasonic transducer comprises a plurality of first specified structures and a plurality of second specified structures which are alternately arranged in the horizontal direction.

Claim 8 (original): An ultrasonic probe according to claim 2, wherein
the ultrasonic transducer is an array transducer,
each of the first gap region and the second gap region has a separating slit, and
each of the first part, the second part, and the third part is a transducer element forming the array transducer.

Claim 9 (original): An ultrasonic probe according to claim 2, wherein
each of the first part, the second part, and the third part is vertically layered and is compounded in the horizontal direction.

Claim 10 (original): An ultrasonic probe according to claim 9, wherein
the direction of compounding is a first horizontal direction corresponding to a direction in which the first part, the second part, and the third part are arranged.

Claim 11 (original): An ultrasonic probe according to claim 9, wherein
the direction of compounding is a second horizontal direction which is orthogonal to a first horizontal direction corresponding to a direction in which the first part, the second part, and the third part are arranged.

Claim 12 (original): An ultrasonic probe according to claim 9, wherein
the direction of compounding is both a first horizontal direction corresponding to a direction in which the first part, the second part, and the third part are arranged, and a second horizontal direction which is orthogonal to the first horizontal direction.

Claim 13 (original): An ultrasonic probe according to claim 2, wherein

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the ultrasonic transducer is an array transducer, the array transducer comprising a plurality of transducer elements, and each transducer element including the first part, the second part, and the third part.

Claim 14 (original): An ultrasonic probe according to claim 13, wherein each of the transducer elements is vertically layered and is compounded in the longitudinal direction of the element.

Claim 15 (original): An ultrasonic probe according to claim 2, wherein each of the first part, the second part, and the third part includes a piezoelectric section and a resin section which are coupled in the horizontal direction, the piezoelectric section having a layered configuration and the resin section being formed by filling.

Claim 16 (currently amended): An ultrasonic probe comprising an array transducer including a plurality of transducer elements, wherein each of the transducer elements comprises:

a piezoelectric section body including a plurality of first horizontal electrode layers and a plurality of second horizontal electrode layers which are provided alternately in the Z direction;

a first vertical electrode layer electrically connected with the plurality of first horizontal electrode layers; and

a second vertical electrode layer electrically connected with the plurality of second horizontal electrode layers,

a first vertical insulating layer extending in a sheet-like manner in the vertical direction between a first side surface of the piezoelectric section body and the first vertical electrode layer, the first vertical insulating layer insulating the first vertical electrode layer from an inner electrode layer within the plurality of second horizontal electrode layers; and

a second vertical insulating layer extending in a sheet-like manner in the vertical direction between a second side surface of the piezoelectric section body and the second vertical electrode layer, the second vertical insulating layer insulating the second vertical electrode layer from an inner electrode layer within the plurality of first horizontal electrode layers;

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the array transducer comprises a plurality of first specified structures and a plurality of second specified structures which are alternately provided in the X direction, in each of the first specified structures, two first vertical electrode layers of two adjoining transducer elements are adjacent to each other via a first gap region, and in each of the second specified structures, two second vertical electrode layers of two adjoining transducer elements are adjacent to each other via a second gap region.

Claim 17 (cancelled).

Claim 18 (cancelled).

Claim 19 (original): An ultrasonic probe according to claim 16, wherein each of the transducer elements has a three-layered configuration.

Claim 20 (original): An ultrasonic probe according to claim 16, wherein a backing including a plurality of signal lines is provided on the bottom surface side of the array transducer, end parts of the plurality of signal lines being arranged on the top surface of the backing so as to correspond to the arrangement of the plurality of transducer elements.

Claim 21 (original): An ultrasonic probe according to claim 16, wherein a ground member and a matching layer are provided on the top surface side of the array transducer.

Claim 22 (original): An ultrasonic probe according to claim 16, wherein each of the transducer elements comprises at least one piezoelectric section and at least one resin section which are coupled in the Y direction which is orthogonal to the X direction.

Claim 23 (original): An ultrasonic probe according to claim 16, wherein each of the transducer elements comprises at least one piezoelectric section and at least one resin section which are coupled in the X direction.

Claim 24 (original): An ultrasonic probe according to claim 16, wherein each of the transducer elements comprises a plurality of piezoelectric sections and a plurality of resin sections which are coupled in the X direction and in the Y direction which is orthogonal to the X direction.

Claim 25 (currently amended): An ultrasonic probe comprising an array transducer including a plurality of transducer elements, wherein

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each of the transducer elements comprises at least one piezoelectric section and at least one resin section which are coupled in the horizontal direction,

the at least one piezoelectric section including a plurality of piezoelectric layers and a plurality of horizontal electrode layers which are laminated in a predetermined order in the vertical direction and a pair of vertical electrode layers which are electrically connected to the plurality of horizontal electrode layers so as to establish a predetermined connection relationship with the plurality of horizontal electrode layers,

the at least one piezoelectric section further including a pair of sheet-shaped vertical insulating layers extending in the vertical direction provided between both side surfaces of a piezoelectric section body and the pair of vertical electrode layers, the piezoelectric section body formed of the plurality of piezoelectric layers and the plurality of horizontal electrode layers;

the at least one resin section being formed as a filler layer having continuity in the vertical direction, and

each of the transducer elements is vertically layered and is compounded in the horizontal direction.

Claim 26 (cancelled).

Claim 27 (original): An ultrasonic probe according to claim 25, wherein each of the transducer elements is compounded in one of a first horizontal direction and a second horizontal direction.

Claim 28 (original): An ultrasonic probe according to claim 25, wherein each of the transducer elements is compounded in both a first horizontal direction and a second horizontal direction.

Claim 29 (withdrawn).

Claim 30 (withdrawn).

Claim 31 (withdrawn).

Claim 32 (withdrawn).

Claim 33 (withdrawn).

Claim 34 (withdrawn).

Claim 35 (withdrawn).

Claim 36 (withdrawn).

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Claim 37 (withdrawn).

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